

BULLETIN

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MISCELLANEOUS INFORMATION.

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D.—COLD STORAGE OF FRUIT.

The discovery of satisfactory methods for storing fruit either at home or in the colonies is obviously a matter of great importance. At home it would counteract the effect of a "glut," and enable a better price to be obtained for the crop by allowing it to be placed upon the market over a longer interval. In the colonies it would facilitate the export of fruit from the southern hemisphere to the northern, and even *vice versâ*, so as to give to either a continuous supply of fruit all the year round.

In the *Kew Bulletin* for 1895 (pp. 31-32) an account was given of the method of storing home-grown fruit. In that for 1894 (pp. 187-189), the experiments made in cold storage by the Department of Agriculture and Forests in New South Wales were described.

The following further description of more detailed experiments on the cold storage of fruit is extracted from the eighth *Annual Report on Experimental Farms* (1895), presented to the Canadian Government by William Saunders, Esq., F.L.S., Director, Dominion Experimental Farms, Ottawa (pp. 103-105):—

Nova Scotia has marked an era in her horticultural progress by the establishment of a school of horticulture, under the control of the Provincial Fruit Growers' Association, and the directorship of Prof. E. E. Faville. This is the only school of its kind in Canada, if not in America.

The great success scored by Canada in her exhibit of fruits at the opening of the World's Columbian Exposition, in May 1893, was, in a large measure, due to the cold storage facilities afforded by the World's Fair authorities, and but for the unfortunate burning of the storage building, and with it a great deal of Canadian fruit, the display would have been much more extensive and varied. The fact, however, that summer and autumn apples, like Duchess of Oldenburg, St. Lawrence, and Wealthy, were placed in good condition upon the tables during the months of May and June, gave food for thought to the thinking mind, and raised the question of the usefulness of the system to the commercial grower and the shipper of fruit.



It is well known that cold storage and refrigerator cars have played an important part for some years in the economy of marketing the great Californian fruit product. It is also well known that large dealers in great fruit markets, like Chicago and New York, have used in common with produce and commission men cold storage warehouses, in which to hold perishable fruit during periods of low prices owing to over-stocked markets. Our information on these lines has, however, been rather vague and unsatisfactory.

With the object of ascertaining some facts based upon personal experience, preliminary experiments were instituted on this line during the present season.

Arrangements were made with the Montreal Cold Storage Company for storing packages of the different fruits as they matured. In this connection I beg to acknowledge the courtesy and generous assistance rendered by the managers of this company, Messrs. T. J. Chisholm and D. G. McGillis, in aiding me in carrying out the experiments. Although sufficient time has not elapsed since the initiation of the experiments to permit the collection of information of value regarding the later fruits, yet its degree of usefulness in marketing the earlier and more perishable fruits has been, if not actually defined, quite clearly indicated. The unusual amount of heat and drought in the districts from which the fruit was procured undoubtedly injured the keeping qualities of the fruit under trial. Last year Wealthy apples grown at Ottawa kept in a cold cellar until May. This year many have already decayed and the remainder are very soft, under the same conditions.

#### PEACHES.

Mountain Rose and Early Crawford peaches, wrapped in tissue paper, packed in 20-pound baskets and stored in an atmosphere of 34 degrees Fahr. on September 5th, remained in good condition till October 1st; soon after this they began to show signs of discoloration. The same varieties under the same conditions, without wrappers, on October 1st showed 5 to 6 per cent. decayed. On October 10th 30 per cent. of Mountain Rose, wrapped, had decayed; of Mountain Rose, unwrapped, fully 75 per cent. were rotten. At this date Early Crawfords were in a relatively better condition, as follows:—Wrapped, 10 per cent. decayed; unwrapped 15 per cent. The decayed fruit did not fall away as is usually the case, but instead lost flavour and colour, while retaining its form. The discoloration began first near the stone and worked outwards. Up to October 1st the flavour was unimpaired, but after this it deteriorated rapidly. I may say the fruit was well ripened before storing took place. Such fruit will not keep more than a few days when taken out of cold storage.

#### PLUMS.

Lombard and Monroe plums were stored in baskets, the fruit being wrapped and unwrapped as in the case of the peaches. They were stored on September 6th in a temperature of 34 degrees Fahr., which was maintained uniformly throughout.

The results gained on the whole do not differ materially from those with peaches, and indicate that stone fruits as a class cannot be profitably stored for a longer period than three weeks, and that in the case of fruit originally well ripened, probably not so long; after this period there is a rapid deterioration both in flavour and firmness.

## PEARS.

*Bartlett.*—Fully ripe, wrapped, packed in baskets, stored on September 1st, began to decay November 15th. The same unwrapped were badly decayed on that date.

*Bartlett.*—Fully ripe, wrapped and packed in cases holding from 50 to 75 pears each, were in good condition on December 1st. Flavour unimpaired. On December 10th 25 to 30 per cent. were rotten; on December 15th fully 50 per cent. had decayed. Flavour somewhat impaired.

*Flemish Beauty.*—Fully matured, wrapped and packed in baskets, decayed earlier than Bartlett, beginning to show signs of rotting on October 15th. The same variety unwrapped began to decay on October 6th.

*Flemish Beauty.*—Fully matured, wrapped and packed in kegs, were in good condition up to November 1st; they decayed rapidly after this and few remained by December 10th.

The unwrapped in kegs had entirely "wasted" by December 6th.

*Beurré Clairgeau.*—Wrapped in baskets, were in good condition when last examined, December 31st. The same unwrapped were also in good condition on the same day.

*Beurré d'Anjou.*—Wrapped and packed in kegs and boxes, were also in good condition on December 10th; and the same may be said of Duchess.

It will be seen that matured Bartlett and Flemish Beauty cannot be safely kept in storage after November 15th or at latest December 1st.

## APPLES.

Trial packages of three varieties of these were sent to the storage warehouse from the Central Farm as they ripened.

*Yatofsky.*—Wrapped, packed in baskets, were in good condition with flavour unimpaired up to November 15th, when they commenced to discolour and lose flavour. On December 10th the greater proportion were decayed and unfit for use. There was a little difference in favour of the wrapped fruit, but the improvement was not so marked as in the case of the pears.

*Duchess.*—Packed the same way, began to decay on December 10th; the same variety unwrapped showed 8 to 10 per cent. of rotten fruit at this date.

*Wealthy and Colvert.*—Both in boxes and barrels, unwrapped, are of course perfect at this date, December 31st. Summer apples, in common with other soft fruits, kept best when wrapped in tissue paper and put up in wooden packages.

## GRAPES.

Sample baskets of Lindley, Delaware, and Niagara grapes, stored on September 27th, are at this date, December 20th, in good condition.



The deductions which may be drawn from the results of this preliminary trial in the preservation of fruits by cold storage may be summarized as follows :—

1. Fruit for storage should be picked when fully grown, but before it has thoroughly matured.
2. Early pears, peaches, and the larger varieties of plums should be wrapped separately in tissue paper.
3. Tight wooden boxes are the most satisfactory packages for storing and handling. When baskets are used they should be provided with strong "veneer" covers.
4. Stone fruits, such as peaches and plums, under ordinary circumstances should not be held for a longer period than two or three weeks.
5. The marketing season for early pears and apples may be extended from 30 to 60 days, and under favourable circumstances for a longer period.
6. The outcome of experiments with fall and early winter varieties of apples and pears, including samples of grapes, yet remains to be developed.

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I have, &c.,  
JOHN CRAIG,  
Horticulturist.

## DI.—DECADES KEWENSES

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

### DECADES XXVI., XXVII.

THROUGH Mr. H. N. Ridley, director of the Gardens and Forest Department of the Straits Settlements, Kew has received a small collection of dried plants, made and presented by Mr. A. H. Everett, a gentleman engaged more especially in collecting birds and insects, whom the former had induced to collect plants. The plants in question are from the previously unexplored Lompo-Batang, or Bonthain Peak, in South Celebes. This peak rises to a height of about 10,200 feet, and the plants were obtained from elevations of 7,000 to 10,000 feet. Mr. Everett's specimens are mostly good so far as they go, but he ascended the peak in October when few of the plants were either in flower or in fruit; consequently a number which are evidently new cannot be described. Among these are two species of *Vaccinium*, a *Leptospermum*, a *Freycinetia*, and four species of *Elatostema*. Several prove to be identical with species inhabiting Mount Kinabalu, North Borneo, as *Ranunculus Lowii*, *Potentilla leuconota*, *Leucopogon suaveolens* and *Quercus Havilandii*. Interesting among grasses is a variety of the Japanese *Festuca parvigluma*, to which, with fuller material, it may be found desirable to give specific rank. There is also a *Danthonia* closely allied to the Australian *D. penicillata*; and there are 30 species of vascular cryptogams, but no new species. *Lycopodium clavatum*



indicates the existence of a strictly temperate zone in Celebes. Among the novelties described in the following decade, *Trachymene celebica* is the most striking and one of the most interesting in relation to the geographical distribution of the genus, which, with the exception of one species in North Borneo, was not previously known out of Australasia.

251. *Clematis Everetti*, *Hemsl.* [Ranunculaceæ]; per petiolos scandens, præter flores glabra, caulibus tenuiusculis striatis, internodiis quam folia nunc brevioribus nunc longioribus, foliis simplicibus longe petiolatis subcoriaceis (adultis non visis) cordatis integerrimis obtuse gradatim acuminatis subquinenerviis nitidis, floribus parvis vel minutis (bene evolutis non visis) axillaribus solitariis vel 2-3 aggregatis brevissime pedunculatis, sepalis 6 crassis dense ferrugineo-pubescentibus.

*Habitat.* — South Celebes: Bonthain Peak at 10,000 ft., *A. H. Everett*, 5.

*Folia* cum petiolis 5-7 poll. longa,  $2\frac{1}{2}$ - $3\frac{1}{2}$  poll. lata. *Pedunculi* (vix evoluti?) circiter semipollicares. *Alabastris* 3-4 lin. diametro.

The simple, shining, 5-nerved leaves, and very small flowers of six sepals sufficiently characterise this species, which is near *C. smilacifolia*, Wall.

252. *Begonia* (§ *Haagea*) *bonthainensis*, *Hemsl.* [Begoniaceæ]; caulescens, omnino glabra vel cito glabrescens, ramosa, ramulis vix carnosus flexuosis ad nodos incrassatis, foliis longe petiolatis siccis tenuissimis oblique ovatis semicordatis multilobulatis simul denticulatis vel duplicato-dentatis acuminatis a basi 7-9-nerviis, pedunculis axillaribus quam folia multo brevioribus sæpius bifloris interdum plurifloris, floribus masculinis mediocribus distincte pedicellatis, sepalis 2 late ovalibus vel suborbicularibus, staminibus numerosis filamentis liberis filiformibus inæquilongis, antheris clavatis connectivo inappendiculato, floribus femineis non visis, capsula subæqualiter anguste trialata apice truncata.

*Habitat.* — South Celebes: Bonthain Peak at 7000 to 10,000 ft., *A. H. Everett*, 34.

*Folia* absque petiolo 3-6 poll. longa, petiolis 2-4 poll. longis. *Inflorescentia* 3-4 poll. longa. *Sepala* circiter 9 lin. longa et 6-7 lin. lata. *Capsula* 8-9 lin. lata et 6 lin. longæ.

253. *Trachymene celebica*, *Hemsl.* [Umbelliferae]; robusta, caudice crasso ut videtur prostrato coma foliorum hornotinorum confertorum terminante, caulibus floriferis erectis e basi comæ foliorum ortis sæpius trichotomis petiolisque pilis longissimis patentibus atrorubris (saltem in siccis) vestitis, foliis radicalibus longe petiolatis crassis herbaceis mollibus utrinque dense appresseque hirsutis vel fere strigosis circumscriptione rotundatis basi cordatis sæpissime alte 6-lobatis lobis plus minusve lobulatis simul crebre denticulatis caulinis paucis ad ramificationes similibus sed minoribus breviter petiolatis magis alte lobatis, pedunculis crassiusculis, umbellis subunisexualibus multiradiatis, radiis umbellarum feminearum crassiusculis rigidis confertissimis, involucri bracteis lineari-subulatis ciliato-fimbriatis radios æquantibus, calycis dentibus minutissimis, petalis conspicuis oblongis apiculatis, fructu cordiformi lævi minute punctato, carpellis valde lateraliter compressis oblique oblongis vel suborbicularibus marginatis, vittis nullis, stylis elongatis, gynophoro indiviso.



*Habitat*.—South Celebes : Bonthain Peak at 10,000 ft., *A. H. Everett*, 74.

*Caules floriferi* 12–15 poll. alti. *Folia*  $1\frac{1}{2}$ – $3\frac{1}{2}$  poll. diametro, radicalium petiolis 3–6 poll. longis. *Radix* 4–6 lin. longi. *Carpella*  $2\frac{1}{2}$ –3 lin. longa.

254. *Ophiorrhiza pileoides*, *Hemsl.* [Rubiaceæ]; repens, radicans, pubescens, caulibus elongatis gracillimis pilosulis, foliis parvis distincte petiolatis membranaceis lanceolatis vix acutis sæpius undulatis supra cito glabrescentibus subtus pallidioribus ut in margine pilis paucis longiusculis obsitis, pedunculis pseudoterminalibus brevissimis 1-3-floris, capsulis truncatis bracteolis angustissimis parce ciliolatis subtenitis.

*Habitat*.—South Celebes : Bonthain Peak, at 7000 to 10,000 ft., *A. H. Everett*, 31.

*Caules* usque ad 10 poll. longi. *Folia* 5–10 lin. longa. *Capsulae* 2–3 lin. latae.

This is similar to Beccari's 603 from Western Sumatra, but that is a glabrous plant.

255. *Senecio Everetti*, *Hemsl.* [Compositæ]; fruticulus vel herba nana, erecta, lignescens, ferrugineo-pubescens, ramulis graciliusculis, internodiis brevissimis, foliis crassiusculis chartaceis sessilibus ovato-oblongis infra medium subito constrictis angustis basi auriculatis grosse crenatis venis obscuris, capitulis homogamis discoideis paucis parvis paucifloris corymbosis breviter pedunculatis, corymbis terminalibus, involucri ecalyculati bracteis uniseriatis ferrugineo-pubescentibus linearibus vix acutis quam flores paullo brevioribus, corollæ alte lobatæ glabræ tubo brevi tenuissimo lobis angustissimis, styli ramis truncatis penicillatis, achæniis (maturis non visis) cylindricis striatis glabris.

*Habitat*.—South Celebes : Bonthain Peak at 10,000 ft., *A. H. Everett*, 87.

*Folia*  $1\frac{1}{2}$ –2 poll. longa, 5–10 lin. lata. Bracteæ circiter 3 lin. longæ.

256. *Scævola similis*, *Hemsl.* [Goodeniaceæ]; *S. oppositifoliae* arcte affinis et persimilis sed foliis distincte denticulatis floribus tetrameris filamentis glabris; præter foliorum axillas barbata et inflorescentiam glabra vel cito glabrescens, ramulis gracillimis viridibus, foliis oppositis graciliter breviterque petiolatis tenuissimis lanceolatis longe acuminatis basi rotundatis remote calloso denticulatis, pedunculis axillaribus brevissimis sæpe trifloris, floribus parvis per anthesin sessilibus tetrameris (an semper ?), calycis dentibus minutis crassis ovato-oblongis obtusis glabris, corollæ extus dense pubescentis lobis æqualibus intus infra medium hirsutis, filamentis glabris, ovario pubescente, stylo crasso glabro, stigmate barbato.

*Habitat*.—South Celebes : Bonthain Peak, at 7000 to 10,000 ft., *A. H. Everett*, 58 in part.

*Folia* cum petiolo 2–3 poll. longa. *Flores*  $3\frac{1}{2}$ –4 lin. longi.

This belongs to a small group of closely allied species—*S. oppositifolia*, Roxb., *S. amboinensis*, Miq., and *S. novoguineensis*, Schum., inhabiting Ternate, Amboina and New Guinea respectively.

257. *Gentiana lateriflora*, *Hemsl.* [Gentianaceæ]; perennis ? glabra, caulibus erectis vel adscendentibus crassiusculis ramosis, foliis crassius-



culis basi connatis internodos breves omnino vel in parte vaginantibus anguste lanceolato-oblongis obtusis, floribus mediocribus ad apices ramulorum lateralium solitariis subsessilibus, calycis lobis crassiusculis linearibus subacutis recurvis, corollæ cylindricæ lobis brevibus ovatis acutis erectis dentibus parvis deltoideis alternantibus, fauce nuda, staminibus inclusis filamentis deorsum leviter dilatatis, capsula longe stipitata, seminibus oblongis vel ovoideis insigniter reticulatis.

*Habitat.*—South Celebes: Bonthain Peak at 10,000 ft., *A. H. Everett*, 78.

*Planta* 3-9 poll. alta. *Folia* 6-18 lin. longa. *Flores* circiter 15 lin. longi.

258. *Strobilanthes Everetti*, *Rolfe*; caulibus puberulis foliis petiolatis lanceolatis v. elliptico-lanceolatis acuminatis crenatis membranaceis strigulosis supra viridibus subtus glaucis, spicis terminalibus laxis paucifloris, floribus alternis subsessilibus, bracteis lanceolatis herbaceis, calycis profunde 5-partiti lobis linearibus subobtusis pubescentibus pilis divaricatis, corollæ tubo brevi fauce ampliata lobis rotundatis apice bilobatis, staminibus 4, capsulis pubescentibus tetraspermis, seminibus parce hirsutis.

*Habitat.*—South Celebes: Bonthain Peak, at 7000 ft., *A. H. Everett*, 28.

*Folia* 1-4 poll. longa,  $\frac{1}{4}$ - $1\frac{1}{2}$  poll. lata; petioli 1-5 lin. longi. *Bracteæ* 5-9 lin. longæ. *Calyx* 4-6 lin. longus. *Corolla* 1 poll. longa. *Capsula* 6 lin. longa.

Much resembling the Himalayan *S. divaricatus*, T. And., to which it is apparently most allied.

259. *Loranthus (Dendrophthoe) celebicus*, *Hemsl.* [Loranthaceæ]; glaber, ramulis floriferis gracillimis crebre lenticellatis, internodiis quam folia multo brevioribus, foliis omnibus oppositis tenuiter coriaceis distincte petiolatis lanceolatis utrinque longe attenuatis acutis venis immersis inconspicuis, floribus gracillimis fasciculatis ternis sessilibus, pedunculis paucis brevibus secus pedunculos communes axillares racemosis, racemis quam folia dimidio brevioribus, florum fasciculis tribracteolatis, bracteolis brevibus latis rotundatis margine scariosis erosis, calyce truncato margine scarioso, corolla anguste cylindrica recta.

*Habitat.*—South Celebes: Bonthain Peak, 7000-10,000 ft., *A. H. Everett*.

*Folia* 2-3½ poll. longa, 6-12 lin. lata. *Pedunculi communes* 9-12 lin. longi. *Fasciculorum pedunculi* 1½-2 lin. longi. *Flores* 12-14 lin. longi.

Near *L. stenopetalus*, Oliv. in Hooker's *Icones Plantarum*, t. 1223.

260. *Podocarpus celebica*, *Hemsl.* [Coniferæ]; species *P. affini* et *P. ferrugineæ* similis, a priori differt foliis alternis a posteriore differt foliis tenuioribus acutisque; ramulis ultimis gracillimis pallide viridibus, foliis alternis distichis tenuibus confertis taxoideis angustissimis acutissimis rectis vel leviter falcatis supra subnitidis subtus opacis pallidioribus. . . . .

*Habitat.*—South Celebes: Bonthain Peak, at 7000-10,000 ft., *A. H. Everett*, 35.

*Folia* circiter pollicaria, 1½-2 lin. lata.



261. *Cyathea dulitensis*, *Baker*. [Filices]; caudice brevi, stipitibus dense caespitosis elongatis brunneis superne nudis prope basin paleis magnis patulis lineari-subulatis membranaceis brunneis praeditis, frondibus oblongo-lanceolatis bipinnatis crassis rigide coriaceis utrinque viridibus glabris nudis, rachi brunneo subnudo, pinnis lanceolatis ad basin pinnatis inferioribus breviter petiolatis infimis reductis deflexis, pinnulis lineari-oblongis subintegris margine revolutis infimis liberis ad costam adnatis, venulis obscuris immersis erecto-patentibus furcatis, soris uniseriatis inter costam et marginem medialibus, indusio campanulato glabro persistente fragili irregulariter rupto.

*Habitat*.—Mount Dulit, Sarawak, Borneo, *Dr. Hose*, 308; collected by Mr. Charles Hose.

*Caudex* pedalis. *Stipites* semipedales. *Lamina* pedalis, 5–6 poll. lata, pinnis 1 poll., pinnulis 2 lin. latis.

262. *Lindsaya* (*Eulindsaya*) *Natunæ*, *Baker*. [Filices]; caudice breviter repente, stipitibus contiguis elongatis nudis pallide brunneis facie sulcatis, frondibus deltoideis bipinnatis membranaceis utrinque viridibus glabris nudis, rachi nudo pallide brunneo, pinnis 3–4-jugis lanceolatis subsessilibus, pinnulis multijugis crebris sessilibus dimidiatis margine inferiore recto integro margine superiore lobato, venis simplicibus laxis perspicuis inferioribus furcatis, soris oblongis ad apices lorum impositis, indusio glabro persistente.

*Habitat*.—Natuna island, midway between North Borneo and the Malay peninsula, *Dr. Hose*, 315; collected by Mr. Ernest Hose.

*Lamina* pedalis. *Pinnæ* 4–5 poll. longæ, 8–9 lin. latæ, pinnulis centralibus 4 lin. longis, 2 lin. latis.

Near *L. guianensis*, Dryand.

263. *Asplenium* (*Euasplenium*) *Gregoriæ*, *Baker* [Filices]; caudice erecto, paleis basalibus densis ascendentibus lanceolatis membranaceis sordide brunneis, stipitibus nudis elongatis, frondibus simplicibus lanceolatis acuminatis integris subcoriaceis utrinque viridibus glabris, venis laxis erecto-patentibus simplicibus vel furcatis, soris brevibus erecto-patentibus ad marginem haud attingentibus, indusio angusto glabro viridi persistente.

*Habitat*.—Madagascar, near Inantasana, *Mrs. Frank Gregory*; collected in 1855.

*Stipites* 2–3 poll. longi. *Lamina* 3–4 poll. longa, infra medium 8–9 lin. lata. *Sori* centrales 3–4 lin. longi.

Near *A. Gautieri*, Hook.

264. *Asplenium* (*Euasplenium*) *microxiphion*, *Baker* [Filices]; caudice erecto, paleis basalibus densis lanceolatis membranaceis sordide brunneis, stipitibus gracilibus caespitosis brevibus nudis, frondibus simplicibus lanceolatis integris acuminatis subcoriaceis utrinque viridibus glabris ad basin attenuatis, venis erecto-patentibus laxè dispositis simplicibus vel furcatis, soris linearibus ad marginem haud attingentibus, indusio membranaceo glabro persistente.

*Habitat*.—Natuna island, *Dr. Hose*, 322; collected by Mr. Ernest Hose.

*Stipites* 1–2 poll. longi. *Lamina* 6–8 poll. longa, medio 4–7 lin. lata. *Sori* 2–2½ lin. longi.

Near *A. ensiforme*, Wall.



265. *Asplenium* (*Euasplenium*) *Natunæ*, *Baker* [Filices]; caudice erecto lignoso, paleis basalibus densis erectis lanceolatis membranaceis sordide brunneis, stipitibus elongatis brunneis ad apicem minute paleaceis, frondibus simplicibus integris lanceolatis rigide coriaceis basi angustatis facie glabris dorso minute paleaceis, venis crebris obscuris immersis ad marginem productis, soris linearibus ad marginem haud productis, indusio glabro persistente.

*Habitat*.—Natuna island, *Dr. Hose*, 321; collected by Mr. Ernest Hose.

*Stipites* 4–6 poll. longi. *Lamina* pedalis vel sesquipedalis, medio 12–21 lin. lata. *Sori* 5–6 lin. longi.

Near *A. serratum*, Linn.

266. *Nephrodium* (*Eunephrodium*) *oosorum*, *Baker* [Filices]; stipitibus nudis elongatis griseis pubescentibus, frondibus oblongo-lanceolatis bipinnatifidis subcoriaceis utrinque pubescentibus rachi nudo pubescente, pinnis multijugis sessilibus lanceolatis ad medium pinnatifidis infimis centralibus æquilongis, lobis ovato-lanceolatis crenulatis leviter falcatis, venulis simplicibus erecto-patentibus perspicuis 10–12-jugis, soris oblongis inter costam et marginem medialibus, indusio membranaceo persistente pubescente.

*Habitat*.—British North Borneo, near Gaya, *Dr. Hose*, 334.

*Caudicem* non vidi. *Stipites* pedales. *Lamina*  $1\frac{1}{2}$ –2 pedalis, 6–7 poll. diam. *Pinnæ* centrales 3–4 poll. longæ, 7–8 lin. latæ, lobis basi 1 lin. latis.

Near *N. invisum*, Carruth., from which it differs in its oblong sori.

267. *Nephrodium* (*Sagenia*) *Everettii*, *Baker* [Filices]; stipitibus gracilibus elongatis nudis castaneis, frondibus deltoideis membranaceis glabris utrinque viridibus ad alam angustam pinnatifidis, pinnis bijugis lanceolatis vel oblongo-lanceolatis acuminatis integris basi confluentibus infimis maximis, venis primariis ad marginem productis arcuatis parallelis, venulis in areolis parvis copiosis venulis liberis inclusis anastomosantibus, soris sparsis copiosis parvis glabris superficialibus, indusio membranaceo glabro persistente.

*Habitat*.—Natuna island, *Dr. Hose*, 332; collected by Mr. A. H. Everett.

*Caudicem* non vidi. *Stipites* 7–8 poll. longi. *Lamina* 9–10 poll. longa et lata, segmentis primariis, deorsum 1–2 poll. latis.

Near *N. ternatum*, Baker.

268. *Polypodium* (*Eupolypodium*) *Newtoni*, *Baker* [Filices]; caudice erecto, paleis basalibus lanceolatis brunneis membranaceis, stipitibus brevissimis nudis, frondibus linearibus glabris elasticis viridibus simpliciter pinnatis, rachi nigrescente, pinnis alternis multijugis inæquilateraliter deltoideis obtusis latere inferiore productis inferioribus sensim minoribus, venâ centrali pinnarum nigrescente simplici ad apicem haud producta, soris globosis superficialibus ad basin pinnarum solitariis.

*Habitat*.—Clarence peak, Fernando Po, alt. 8000–9000 ft., on the stems of *Erica arborea*, *Newton*.

*Lamina*  $1\frac{1}{2}$ –2 poll. longa, medio  $1\frac{1}{2}$ –2 lin. lata.

Near the Jamaican *P. exiguum*, Griseb.



269. *Polypodium* (Phymatodes) *cyclobasis*, *Baker* [Filices]; frondibus sessilibus basibus sterilibus orbicularibus valde imbricatis rigide coriaceis venis perspicuis in areolis copiosis hexagonis copiosis anastomosantibus supra basin linearibus integris obtusis ad basin sensim angustatis, soris globosis superficialibus inter costam et marginem irregulariter 1-2-seriatis.

*Habitat*.—North-east New Guinea: 1894, *Rev. C. E. Kennedy*; received from Sir F. von Mueller. Stirling range, ascending to 1500 ft., *Micholitz*; received from Herr Kränzlin.

*Laminae* basi sterilis 3-4 poll. longa et lata; apex fertilis pedalis, medio 4 lin. lata. *Sori* 1 lin. diam.

A most distinct species, with fronds combining an entire linear fertile tip, with an orbicular sessile drynarioid base.

270. *Acrostichum* (Elaphoglossum) *clarenceanum*, *Baker* [Filices]; caudice breviter repente, paleis basalibus densissimis linearibus brunneis membranaceis, stipitibus brevibus ad apicem paleis linearibus pallide brunneis membranaceis squarrosis præditis, frondibus sterilibus lineari-oblongis integris obtusis subcoriaceis basi angustatis utrinque paleis copiosis ovato-lanceolatis vel lanceolatis acuminatis membranaceis brunneis adpressis præditis, venis erecto-patentibus obscuris immersis simplicibus vel furcatis, frondibus fertilibus ignotis.

*Habitat*.—Clarence peak, Fernando Po, alt. 6000-7000 ft., on trees, *Newton*.

*Stipites*  $1\frac{1}{2}$ -2 poll. longi. *Lamina* sterilis 3-4 poll. longa, medio 9-10 lin. lata.

Near *A. spathulatum*, *Bory*.

## DII.—DOMINICA.

This picturesque and interesting island has occupied a good deal of attention of late years. In spite of its fertile soil and healthy climate its resources are still quite undeveloped. At the present moment its condition is such as to cause grave concern both at home and in the Presidency itself. A reference to the information published from time to time in the *Kew Bulletin* was given in the volume for 1894 (pp. 405-410).

A general review of the agricultural resources of Dominica with an account of the establishment of a Botanic Station in the island will be found in a Report prepared by the Assistant Director of Kew, after his visit to the island in 1890 (*Kew Bulletin*, 1891, pp. 115-119).

Very valuable information of later date is contained in the Report of the Royal Commission appointed to hold an inquiry in the island in 1893. This was prepared by the late Sir Robert G. C. Hamilton, K.C.B. An extract from this Report with an appreciative account of the work done at the Botanic Station in promoting local industries is published in the *Kew Bulletin*, 1894 (pp. 405-410).

The following despatch from the Secretary of State for the Colonies published in the *Dominican* of December 12, 1895, shows that efforts



are being made to grapple with the situation and place the finances of the island on a more satisfactory footing :—

Administrator's Office, Dominica,  
December 6, 1895.

The following Despatch from the Right Honourable the Secretary of State to his Excellency the Governor-in-Chief is published for general information :—

SIR, Downing Street, November 19, 1895.

THE serious financial position of Dominica has for some time engaged my serious attention. It appears that with a funded debt amounting to 70,900*l.* and an annually recurring deficit, a further sum of about 10,000*l.* is urgently required to pay off the floating debt, and to furnish a working balance, and that there is urgent need for certain public works, viz., the repair of the Infirmary, the re-building of the Roseau Jetty, the repair of the Court House, the construction of bridges, and completion of existing roads, the aggregate cost of which is estimated to be about 5,000*l.*

2. I am at the same time aware of the universal testimony which is borne to the natural richness of the island, and of the absolute necessity of roads or railways for its development; and I have had before me the late Sir Robert Hamilton's Report and the subsequent correspondence.

3. I am satisfied that at the present time the financial position of the Presidency does not admit of its undertaking fresh liabilities in the shape of a further loan for the construction of roads or railways, and that on the other hand without better communications and the opening up of the rich districts at present undeveloped on account of their inaccessibility population will continue to leave the island, and that capital will flow out of it instead of into it with the result of diminishing revenue, and general decadence.

4. I have, therefore, further considered the question of affording Imperial assistance to Dominica, and while I concur in my predecessor's view that any actual claim to such assistance founded on the receipt by the Imperial Treasury of the proceeds of the sales of lands in 1765 to 1773 is too remote to be considered now, I think that this circumstance affords some justification for exceptional treatment.

5. Any such assistance, in whatever form, will necessarily require the consent of the Lords Commissioners of the Treasury, and of Parliament, and until that consent is obtained it is impossible for me to pledge myself in any way; but I may say that my desire is to assist the Presidency in developing its undoubtedly rich resources, and to help to place it on a sound financial basis.

6. Before, however, I can be in a position to ask such assistance I must know that the Legislature of Dominica, as I have no doubt will be the case, are prepared to do their part towards the attainment of these objects, and more particularly that the Legislature are willing to vote the additional taxation which is required to make the revenue balance the expenditure, and to transfer the expenditure of the town of Roseau to a Town Board to be met by municipal taxation as recommended by Sir R. Hamilton.

7. As some time must, in any case, elapse before any decision can be arrived at as to the measures to be adopted, it will be necessary to make temporary provision for the 15,000*l.* which is immediately required.

In framing the estimates for 1895 the Administrator should provide for a sufficient revenue to cover the ordinary expenditure, but the



question of providing for the repayment of the floating debt and for the cost of the works which are mentioned in paragraph 1 of this Despatch may be left in abeyance for the present and the introduction of a Bill providing the raising of a loan by Treasury Bills as authorised by my Despatch No. 258 of the 8th of October should be deferred.

In order to save time I am sending a duplicate of this Despatch to the Administrator of Dominica.

I have, &c.  
(Signed) J. CHAMBERLAIN.

### DIII.—NEW ORCHIDS.—DECADE 16.

151. *Restrepia sanguinea*, Rolfe; caule secundario brevi, vaginis lanceolatis acutis conduplicatis carinatis immaculatis, foliis ellipticis subobtusis apice minutissime tridenticulatis, pedunculis gracilibus, bracteis basi tubulosis apice triangulari-ovatis acutis, sepalo postico basi lanceolato abrupte valde attenuato apice subclavato lateralibus ad medium v. ultra connatis lobis apice subacutis, petalis basi lineari-lanceolatis abrupte valde attenuatis apice subclavatis, labello subpandurato-oblongo truncato verruculoso lobis lateralibus falcato-setaceis, columna clavata incurva.

HAB.—Colombia.

*Folia*  $1\frac{3}{4}$  poll. longa, 8 lin. lata. *Vaginæ* 10 lin. longæ. *Pedunculi*  $1\frac{1}{2}$ – $1\frac{3}{4}$  poll. longi. *Bracteæ* 3 lin. longæ. *Sepala* 9 lin. longa. *Petala*  $7\frac{1}{2}$  lin. longa. *Labellum* 5 lin. longum,  $1\frac{1}{2}$  lin. latum. *Columna* 3 lin. longa.

Introduced by Messrs. Charlesworth & Co., of Bradford, with whom it flowered in November last. It much resembles *R. pandurata*, Rehb. f., in general character, but apart from structure it differs from that and every other species in having wholly crimson flowers, with the exception of a small yellow blotch at the base of the column and the extreme base of the lateral sepals.

152. *Dendrobium quadrilobum*, Rolfe; sarmentosa, caulibus ramosis, pseudobulbis fusiformi-oblongis brevibus monophyllis, foliis oblongis v. elliptico-oblongis obtusis sessilibus, floribus terminalibus solitariis, bracteis ovatis acutis concavis, sepalo postico ovato-oblongo subobtusolateralibus apice triangulo-ovatis obtusis basi cum pede columnæ in mentum longum extensis, petalis ovato-oblongis obtusis, labello trilobo lobis lateralibus erectis angustis apice rotundatis denticulatis intermedio profunde obcordato-bilobo laciniis rotundatis, disco bicarinato, columna brevissima.

HAB.—Uncertain, but probably New Guinea or one of the adjacent islands.

*Caules* 6–9 poll. longi. *Pseudobulbi*  $\frac{1}{2}$ –1 poll. longi. *Folia*  $1$ – $1\frac{1}{2}$  poll. longa, 5–7 lin. lata. *Bracteæ* 1 lin. longæ. *Pedicelli* 6 lin. longi. *Sepalum* posticum 4 lin. longum, 2 lin. latum; lateralia 1 poll. longa, 4 lin. lata. *Petala* 4 lin. longa,  $1\frac{1}{2}$  lin. lata. *Labellum* 11 lin. longum, 6 lin. latum. *Columna* 1 lin. longa. *Mentum* 9 lin. longum.

A very distinct species of the section *Cadetia*, received in 1895 along with other Dendrobes, from F. A. Newdigate, Esq., M.P., Nun-eaton, who obtained them from Australia. It flowered at Kew in



October last. The leaves are unusually small, and the flowers large for the section, and uniformly pale whitish green.

153. *Bulbophyllum longiscapum*, *Rolfe*; rhizomate repente valido, pseudobulbis ovoideis monophyllis, foliis lineari-oblongis subacutis coriaceis breviter petiolatis, scapis elongatis gracilibus apice floriferis, bracteis distichis imbricatis conduplicatis carinatis triangularibus acutis, floribus paucis singillatim evolutis mediocribus, sepalo postico triangulari-lanceolato acuminato lateralibus similibus basi latis, petalis parvis late ovato-oblongis denticulatis apice setiferis, labello elongato basi lato bicarinato apice gradatim attenuato acuto carnosio latere undulato lobis lateralibus erectis oblongis subobtusis brevibus carnosius, columna oblonga dentibus setiformibus.

HAB.—Fiji.

*Pseudobulbi*  $\frac{3}{4}$ –1 poll. longi. *Folia* 4–5 poll. longa, 9–14 lin. lata. *Scapi*  $1\frac{1}{2}$  ped. longi. *Bractea* 4–5 lin. longæ. *Pedicelli* 4 lin. longi. *Sepala* 10 lin. longa. *Petala* 1 lin. longa. *Labellum* 8 lin. longum. *Columna* 3 lin. longa.

Sent to Kew by Mr. Yeoward, Curator, Botanical Station, Fiji, in 1891, with *Hydnophytum longiflorum*, A. Gray. It flowered in November last, and is remarkable in having a long scape and short raceme, and a long attenuated lip. The flowers are light green, except the foot of the column and the lip, which are red-purple, the latter passing to deep yellow at the tip. The mid-nerve of the petals is also purple.

154. *Bulbophyllum macrochilum*, *Rolfe*; pseudobulbis ovatis parvis monophyllis, foliis lineari-oblongis subacutis basi subattenuatis, scapis elongatis gracilibus apice floriferis, bracteis ovato-oblongis acutis carinatis, floribus paucis singillatim evolutis mediocribus, sepalis lineari-lanceolatis acuminatis, petalis late ovatis subacutis crenulatis, labello elongato lineari-lanceolato acuminato latere undulato lobis lateralibus erectis falcato-linearibus, columna oblonga dentibus brevibus.

HAB.—Borneo, *G. D. Haviland*.

*Pseudobulbi* 4–5 lin. longi. *Folia*  $5\frac{1}{2}$  poll. longa, 11 lin. lata. *Scapi* 10 poll. longi. *Bractea* 3–4 lin. longæ. *Pedicelli* 4 lin. longi. *Sepala* 10–11 lin. longa. *Petala* 1 lin. longa. *Labellum* 9 lin. longum. *Columna* 2 lin. longa.

Closely allied to the preceding, but readily distinguished by the absence of a bristle at the apex of the petals, the short teeth of the column, and the different colour. Dr. Haviland records the latter as—“Perianth with pink longitudinal veins; lip pink; column yellow.”

155. *Bulbophyllum attenuatum*, *Rolfe*; scapis elongatis gracilibus apice floriferis, bracteis distichis conduplicatis carinatis triangulari-ovatis, floribus paucis singillatim evolutis mediocribus, sepalo postico lineari-lanceolato apice caudato-attenuato lateralibus basi triangularibus apice caudato-attenuatis, petalis lanceolato-ovatis acutis v. apiculatis integris, labello basi elliptico integro apice caudato-attenuato lineo medio carnosiusculo, columna brevi dentibus brevibus.

HAB.—Borneo.

*Scapi* 9 poll. longi. *Bractea* 4 lin. longæ. *Pedicelli* 6 lin. longi. *Sepala*  $1-1\frac{1}{4}$  poll. longa. *Petala* 1 lin. longa. *Labellum* 10 lin. longum. *Columna* 1 lin. longa.

Habit of the preceding species, but differing in having caudate-sepals and lip; the latter without side-lobes. Introduced by Messrs. Linden, with whom it flowered in October, 1892. The sepals are veined with maroon-purple on a lighter ground, and the rest of the flower strongly suffused with the same colour.

156. *Lanium subulatum*, Rolfe; pseudobulbis ovoideo-oblongis v. oblongis diphyllis, foliis lineari-subulatis subacutis carnosis subteretibus canaliculatis arcuatis, paniculis pauci-ramosis brevibus pubescentibus, bracteis lanceolatis acutis, sepalis late lanceolatis subacutis subconcavis extus pubescentibus, petalis linearibus subacutis, labello elliptico-ovato breviter acuminato concavo nervo medio crassiusculo, columna clavata.

HAB.—Brazil, prov. Minas Geraes.

*Pseudobulbi* 6–9 lin. longi. *Folia*  $1\frac{1}{4}$ – $1\frac{3}{4}$  poll. longa,  $1$ – $1\frac{1}{4}$  lin. lata. *Paniculae*  $1\frac{1}{2}$  poll. longæ. *Bractea*  $\frac{3}{4}$  lin. longæ. *Pedicelli*  $1\frac{1}{2}$  lin. longi. *Sepala* et *petala*  $1\frac{1}{2}$  lin. longa. *Labellum* 1 lin. longum. *Columna*  $\frac{1}{3}$  lin. longa.

A curious little plant, introduced by Messrs. F. Sander & Co. It is the fourth known species of the genus, and differs from the rest in its subulate leaves and much smaller flowers. The colour of the latter is pale green, with a little suffusion of pink in the sepals.

157. *Epidendrum atrorubens*, Rolfe; foliis lineari-oblongis obtusis, scapis paniculatis laxifloris, bracteis ovatis obtusis parvis, sepalis subspathulatis subobtusis, petalis spathulatis subobtusis, labello libero trilobo lobis lateralibus oblongis obtusis intermedio suborbiculari apiculato undulato medio carinato venis elevatis, disco carnosio, columna clavata.

HAB.—Mexico.

*Folia* circa 8 poll. longa,  $1\frac{1}{4}$  poll. lata. *Bractea* 1 lin. longæ. *Pedicelli* 9–10 lin. longi. *Sepala* 9 lin. longa. *Petala* 8 lin. longa. *Labellum* 6 lin. longum. *Columna*  $3\frac{1}{2}$  lin. longa.

This belongs to the section *Encyclium*, and is allied to *E. selligerum*, Batem. and *E. plicatum*, Lindl., but has smaller flowers of much deeper colour. It flowered first with Messrs. Linden, in October 1892. The sepals and petals are very dark red-purple, and the lip a rather lighter shade, in which respect it approaches *E. Hanburyi*, Lindl.

158. *Spiranthes metallica*, Rolfe; foliis rosulatis subsessilibus elliptico-oblongis subacutis metallicis interdum pallido-maculatis, scapis elatis robustis pubescentibus vaginis subdistantibus tectis, bracteis lanceolatis acuminatis concavis pubescentibus, ovariis pubescentibus, sepalis herbaceis pubescentibus lateralibus oblique oblongo-lanceolatis acuminatis basi ovarii marginibus longe decurrentibus tubum longum formantibus liberis postico oblongo-lanceolato cum petalis in galeam connivente apice libero recurvo acuto, petalis lanceolato-oblongis petaloideis apice liberis acutis, labello longe unguiculato apice ovato subacuto recurvo ungue infra medium sagittato, columna brevi.

HAB.—Brazil, Gardner, n. 672, and British Guiana, Mimatta, Jenman, n. 5914.

*Folia* 4–6 poll. longa,  $1\frac{1}{2}$ –3 poll. lata. *Scapi* 1–2 ped. alti. *Bractea*  $\frac{3}{4}$ – $1\frac{1}{4}$  poll. longæ. *Ovaria*  $1\frac{1}{4}$ – $1\frac{1}{2}$  poll. longa. *Sepala* et *petala* 5 lin. longa. *Labelli* unguis  $1$ – $1\frac{1}{4}$  poll. longus, limbus 3–4 lin. longus. *Columna* 3 lin. longa.



Closely allied to *S. picta*, Lindl., but the perianth-segments are only about half the size, and the leaves are of a peculiar olive-brown or metallic shade, frequently bearing a number of paler spots. It first flowered with Messrs. Veitch in 1882. The flowers are light green with a whitish lip.

159. *Macodes sanderiana*, Rolfe; foliis ovato-oblongis v. elliptico-oblongis subacutis in petiolum attenuatis insigniter variegatis, scapo elato pubescente multifloro, bracteis ovatis acutis concavis membranaceis, sepalis ovato-oblongis obtusis concavis, petalis lineari-oblongis obtusis, labello basi ventricoso apice spatulato obtuso, sacco basi biglanduloso apice utrinque auriculato, columna brevi.—*Anectochilus sanderianus*, Kränzl. in Gard. Chron., 1895, xviii., p. 484.

HAB.—Sunda Islands, *Forget*.

*Folia*  $2\frac{1}{2}$ –4 poll. longa,  $1\frac{1}{2}$ –2 poll. lata. *Scapus* 1 ped. altus; racemus 3 poll. longus. *Bractee* 3 lin. longae. *Pedicelli* 4–5 lin. longi. *Sepala* et *petala*  $2\frac{1}{2}$ –3 lin. longa. *Labellum*  $2\frac{1}{2}$  lin. longum. *Columna* 2 lin. longa.

Introduced by Messrs. F. Sander & Co., with whom it flowered in December last. It is allied to *M. argyronœura*, Rolfe (*Hemaria argyronœura*, Miq.), but, among other characters, the venation of the leaf is very different. The leaves are dark olive-green reticulated with greenish-yellow veins, and the flowers pale green lightly suffused with brown.

160. *Holothrix Johnstoni*, Rolfe; scapo piloso, bracteis ovatis acutis concavis pilosis, sepalis oblongis obtusis concavis conniventibus apice pilosis, petalis linearibus obtusis sepalis duplo longioribus, labello basi oblongo apice flabellato-quinquifido lobis oblongis obtusis, calcare brevi conico obtuso, columna brevissima.

HAB.—British Central Africa: upper Plateau of Mlanje, near Zomba, Sir H. H. Johnston.

*Scapi* 5 poll. alti; racemi  $1-1\frac{1}{2}$  poll. longi. *Bractee*  $2-2\frac{1}{2}$  lin. longae. *Pedicelli* 2 lin. longi. *Sepala*  $2\frac{1}{2}$  lin. longa. *Petala* 5 lin. longa. *Labellum*  $1\frac{1}{2}$  lin. longum. *Calcar*  $\frac{1}{2}$  lin. longum. *Columna*  $\frac{1}{2}$  lin. longa.

This resembles the South African *H. condensata*, Sond., but differs in its much larger flowers, and five-lobed lip. The leaves are unknown.

#### DIV.—TWO AFRICAN HOLARRHENAS.

(*Holarrhena africana*, A. DC., and *H. febrifuga*, Klotz.)

In the *Kew Bulletin*, 1895, p. 245, mention is made of *Holarrhena africana*, called at Lagos "the male rubber tree." Specimens of this plant had been received at Kew on two occasions as the true rubber tree of Lagos. The latter, as stated in the *Bulletin*, has been determined to be *Kickxia africana*, Benth.

The chief economic interest attached to *Holarrhena africana* is on account of its medicinal properties. According to Wulfsberg,\* the bark

\* *Holarrhena africana*, A. DC. Inaugural dissertation of N. Wulfsberg (of Christiana). Gottingen, 1880.

is known at the Gold Coast as "Gbomi" or "Kpomi." Harnberger is quoted as having paid the sum of twenty pounds for a native cure for dysentery. This proved to be the bark of *Holarrhena africana* steeped in palm wine. The bark is also said to yield an alkaloid similar to *conessine*, the active principle in the bark of the Indian *H. antidysenterica*. A similar use of the bark of *H. africana* is referred to by Planchon and E. Collin in *Les Drogues Simples*, p. 704.

Mr. G. F. Scott Elliot on specimens of *Holarrhena africana* collected by him at Sierra Leone, simply adds: "The people at Layah use the feathery leaves for pillows." In Oliver's *Flor. Trop. Africa*, iii., 44, it is stated that "*Rondeletia floribunda*, G. Don (Gard. Dict. iii., pp. 5 and 6, No. 17) is *Holarrhena africana*, DC," which belongs to the Apocynaceæ. In the *Bulletin*, p. 245, it was inadvertently referred to the Rubiaceæ. It is apparently confined to West Africa, and all the specimens at Kew are from that region. It ranges from Sierra Leone to the lower Niger, and was sent from Lagos by Captain (now Sir Alfred) Moloney in 1883. We are still without authentic information as to its value, if any, as a rubber plant.

A common plant in East Africa, especially in the Zambesi region, called "Quina" by the Portuguese, and figured in Livingstone's "Missionary Travels," 1857, p. 648, under the native name of "Kumbanzo," is *Holarrhena febrifuga*. This was collected at Tette by Sir John Kirk in 1859; in the Manganja Hills by Mr. C. J. Meller in 1861, and it extends westward beyond Lake Nyanza, and northward to Usambara. Speke and Grant call it "Jasmine" on account of the sweet odour of the flowers. Later specimens in the Kew Herbarium are from Usugara in what is now German East Africa.

Livingstone refers to the use of the bark in cases of fever. The "name and properties of this bark," he says, "made me imagine that it was a cinchonaceous tree." His further account is as follows: "The thick soft bark of the root is the part used by the natives, the Portuguese use that of the tree itself. I immediately began to use a decoction of the bark of the root, and my men found it so efficacious that they collected small quantities of it for themselves and kept it in little bags for future use. Some of them said that they knew it in their own country, but I never happened to observe it. The decoction is given after the first paroxysm of the complaint is over. The Portuguese believe it to have the same effects as quinine, and it may prove a substitute for that invaluable medicine."

This estimation of the value of *Holarrhena febrifuga* in East Africa, as of *H. africana* in West Africa, recalls the use of the allied *H. antidysenterica* in India. The bark of the stem and root and the seeds of the latter "are amongst the most important medicines of the Hindu Materia Medica." (Watt's *Dict. Econ. Prod. India*, iv., 255).

Mr. C. J. Meller, already quoted, collected numerous specimens of *Holarrhena febrifuga*. He, however, says nothing about the medicinal properties of the plant. Attached to specimens collected in the Manganja Hills in 1861 he gives the following information: "'Macongá' or 'Macombi.' Flowers white. Trailing and climbing to a great height, with rough corrugated bark; yields a plentiful thin juice affording the india-rubber of the natives; tree very abundant, Mino." Another specimen of the same plant, also collected by Meller in the Manganja Hills, at an elevation of 1 to 3000 ft., is marked "'Kacopi.' A native rubber is obtained from this and also several others, two of



which are represented in the Mino parcel." The plant is described as "a tree 10-25 feet high, yields a milky juice; flowers white."

It may be added that Dr. Stapf regards *Holarrhena glabra*, Kl., and *H. tettensis*, Kl., both from East Africa, as forms of *H. febrifuga*.

## DV.—NATURAL SUGAR IN TOBACCO.

The following papers record the solution of an interesting problem which was submitted to Kew some years ago by the Treasury. Its primary importance was purely fiscal, but its investigation led to the discovery of some striking facts which do not appear to have been published since.

The "standard authorities" at the time were not prepared to admit "the presence in tobacco of more than a trace of saccharine matter." On the other hand experiments made at Somerset House "with tobacco grown at Kew" showed "a considerable amount of sugar to be present" naturally.

Professor Church was so good as to examine the literature, and it appeared, at least as far as fermented tobacco was concerned, to practically confirm the standard authorities.

It became clear that the question could only be solved by further investigation, and Dr. Hugo Müller, F.R.S., who is an acknowledged authority on the chemistry of the carbo-hydrates, was so good as to undertake it.

The results, as far as the fiscal question was concerned, were absolutely conclusive. From a scientific point of view they were not less valuable. A commercial sample of "Bright Virginia" tobacco was found to contain as much as 15·2 per cent. of saccharine matter. The sun-dried leaves of *Nicotiana Tabacum* grown at Kew contained 6·2 per cent., and those of a form of the same species grown at Ewell Railway Station as much as 9 per cent., "the largest quantity found in the leaves of plants grown in this country."

As to the nature of this sugar, Dr. Hugo Müller was led "to the conclusion that neither lævulose nor glucose was present, and that the saccharine matter of tobacco is composed of at least three different sugar-like substances which, so far as my present knowledge goes, I must consider as new to chemistry."

TREASURY TO ROYAL GARDENS, KEW.

Treasury, S.W., August 7th, 1883.

DEAR SIR JOSEPH HOOKER,

A SOMEWHAT difficult question of botanical chemistry has arisen, in practical form, in connexion with the tobacco duties, upon which Mr. Courtney would be very glad of your advice.

Under the present law and practice, the duty on all tobacco (other than cigars) is 4s. 4d., except in the case of "sweetened" tobacco, which is charged 4s. 10d.; but cigarettes made of the "sweetened" article are not allowed to be imported at all, for reasons with which you need not be troubled. It is in connexion with this prohibition of the importation of "sweetened" cigarettes that the present difficulty has arisen.

Previous law and practice have always assumed that there is no appreciable amount of native sugar in tobacco, and consequently when any was found on analysis it has been assumed to be added. Certain importers have recently asserted that in some sweetened cigarettes of theirs, detained by the Customs, the saccharine matter is not added but native, and have brought forward a report by Professor Attfield, Chemist to the Pharmaceutical Society, in favour of the possibility of this being true. Dr. Bell, the Government Analyst at Somerset House, also reported that the sugar in this case "was natural to the tobacco and had not been added thereto." Moreover, Dr. Bell had made experiments with tobacco grown at Kew (in which there could be no suspicion that anything had been artificially added), and found a considerable amount of sugar to be present.

On the other hand, we are informed that the standard authorities do not admit the presence in tobacco of more than a trace of saccharine matter (Dr. Stevenson's name is mentioned on this side); so that although there seems to be a preponderance of authority in favour of its being (at least occasionally) so present, the question is not free from doubt.

Assuming, however, that the possibility of its presence be admitted, the question arises whether sugar naturally present can practically be distinguished by analysis from that which is added. This is of importance because of the question of allowing cigarettes to be imported; moreover, the higher rate on "sweetened" (manufactured) tobacco is imposed as an equivalent to the restrictions placed on the home manufacturer, and it would not be logically defensible to make the same extra charge if the article were proved to be in its natural condition. Here, again, we have a conflict of opinion, Dr. Bell saying that the added and the natural sugar could be distinguished, while the gentleman who advises the Board of Customs on such questions says they could not be so, *in a tobacco infusion*.

If you could give any advice or suggestion to help the Government in deciding upon these two points, it would be extremely acceptable.

Yours very truly,  
(Signed) S. E. SPRING-RICE.

PROFESSOR CHURCH, F.R.S., TO ROYAL GARDENS, KEW.

#### SUGAR IN TOBACCO.

The presence of a sugar in fresh tobacco seems to have been first ascertained by J. Nessler; see his *Der Tabak, seine Bestandtheile und seine Behandlung*; Mannheim, 1867. The amount is very small and it wholly disappears during the fermentation to which the leaf is subjected in the process of curing. In Grandean's *Traité d'Analyse des Matières Agricoles* (Paris, 1877), page 278, it is stated that the sugar occurs chiefly "*dans la moelle de la tige*." Dr. J. Koenig's *Nahrungs- und Genuss-Mittel* (Berlin, 1879-80) contains a good deal of analytical information about tobacco (see pp. 493 to 502 of Volume II., also pp. 194-8 of Volume I.) The abstract of papers in the *Jahresbericht der Agricultur-Chemie* (24 vols.) contain no further information.

(Signed) A. H. CHURCH.

Shelsley, Kew, August 10, 1883.



DR. HUGO MÜLLER, F.R.S., TO TREASURY.

13, Park Square East, N.W.,

Sir,

17th December 1883.

IN compliance with the request contained in your letter of the 17th August, I have carried out a series of experiments with the view to answering your questions:—

- (1.) As to whether natural saccharine matter is contained in the so-called sun-dried or yellow tobaccos ;
- (2.) Whether such sugar can be distinguished with sufficient certainty for Revenue purposes from that which may be added.

I may state that my answers are both in the affirmative.

I regret the unavoidable delay in rendering this report, but I felt that unless I could devote sufficient time to the carrying out of the experimental work necessary, my opinion could have but little weight.

I have, &c.,

(Signed) HUGO MÜLLER.

Leonard H. Courtney, Esq., M.P.,  
Treasury Chambers, S.W.

#### REPORT on the occurrence of Saccharine Matter in certain kinds of Commercial Tobaccos.

In collecting the materials for this investigation I took pains to secure, as much as possible, good representative specimens of the particular kinds of tobacco in question, and for this purpose I selected myself at wholesale houses the various samples I required from the hogsheads or original packages in which the raw tobacco is imported.

As it appeared to me of special importance to obtain also further evidence as to the presence of sugar or a saccharine matter in the growing tobacco plants, I applied to the authorities of Kew, and I have great pleasure in acknowledging here the readiness with which my request for a supply of leaves was complied with in that quarter. I must, however, not omit to mention that at the time when I was requested to undertake the present investigation, the season was already too far advanced for me to secure a sufficient quantity of fresh material for an exhaustive examination of this subject.

The samples of commercial tobaccos were all of pale colour and most of them were of the kind which in the trade is known as "sun-dried" tobacco.

The following is a list of the sorts I examined:—Algerian, Kentucky, Greek, Turkish, Syrian, Chinese, Virginia leaf, Bright Virginia.

The chemical tests usually employed for the detection of sugar, or saccharine substances, established the fact that nearly all of them contained more or less, and after some preliminary trials I adopted the reduction or Fehling's process for the quantitative determinations. I give in the following list the percentages of saccharine matter thus obtained:—

Algerian	-	-	-	-	none.
Kentucky	-	-	-	-	none.
Greek	-	-	-	-	a trace.
Turkish	-	-	-	-	2·3 per cent.
Syrian	-	-	-	-	2·8 "
Chinese	-	-	-	-	3·5 "

Virginia leaf	-	-	-	5·4 per cent.
„ another sample	-	-	-	7·2 „
„ another sample	-	-	-	9·8 „
Bright Virginia	-	-	-	10·6 „
„ another sample	-	-	-	12·5 „
„ another sample	-	-	-	15·2 „

It will thus be seen that whilst the oriental tobaccos contain only a small quantity, the percentage in some of the Virginian is surprisingly high. The presence of so large an amount of saccharine matter was so unexpected that I thought it desirable to repeat the experiment in this case with three different lots from the same tobacco; but this only served to confirm the former results, the numbers obtained varying only with one half per cent.

To all appearance the quality of the kind of tobaccos under examination coincides with the percentage of saccharine matter, for those which had been pointed out as the better sorts contained the larger quantity.

It seems that the best class of the bright yellow Virginian is characterised by a uniform bright yellowish colour, and by its well developed, unusually large leaves, which are more or less entire, and exhibit a certain toughness and gumminess much appreciated by the manufacturers. It becomes therefore quite possible, after a little practice, to select with comparative ease the kinds of tobaccos which contain a high percentage of saccharine matter.

The oriental tobaccos which I examined were not of a high class, and as I was unable to obtain samples of the better kinds, I am not in a position to state whether these tobaccos ever contain as much saccharine matter as the Virginian.

The Algerian and Kentucky leaf, which were found to be free from saccharine matter, cannot be strictly classed with so-called sun-dried tobaccos, for although of a light colour they were of a distinctly different tint, verging on brown, and this may be considered as an indication that they were not prepared or cured by the same process as the bright Virginian.

The leaves of growing tobacco plants which I received from Kew were collected at the end of August and the beginning of September, and as I was then absent from town they were carefully dried in the sun. The samples were but small, consisting of a few leaves of each sort. Their colour was a faded green and not like that of tobacco.

There were in all ten sorts or varieties of the two principal species *Nicotiana Tabacum* and *Nicotiana rustica*, the former being the one chiefly cultivated in America, whilst the latter seems to furnish most of the oriental tobaccos.

It may be sufficient for the present purpose to state that in all these specimens the presence of saccharine matter was indicated, but very different amounts, as will be seen from the following list:—

<i>Nicotiana texana</i> , var. <i>rustica</i>	-	-	-	1·5 per cent.
Shiraz tobacco	-	-	-	4·6 „
<i>N. rustica</i>	-	-	-	4·0 „
<i>N. Tabacum</i> , var. <i>virginiana</i>	-	-	-	2·3 „
Maryland tobacco	-	-	-	5·0 „
<i>Nicotiana Tabacum</i>	-	-	-	6·2 „
Bhilsa tobacco	-	-	-	3·5 „
<i>N. Tabacum</i> , var. <i>attenuata</i>	-	-	-	3·2 „
<i>N. gigantea</i>	-	-	-	4·2 „
<i>N. macrophylla purpurea</i>	-	-	-	4·5 „



I had also an opportunity of examining green leaves of *N. Tabacum* var. immediately after being taken from plants at the Zoological Gardens, and at Ewell railway station. Of the former, one sample was taken from plants which had not flowered, and it contained nearly 2 per cent., whilst in a second sample from a plant which had flowered a mere trace was detected. The sample from Ewell, however, which was collected in the middle of October, contained a little over 9 per cent., the largest quantity found in the leaves of plants grown in this country, and it is a noteworthy fact that these leaves contained also more starch than any of the other specimens.

It is to be understood that all these percentages are referred to air-dry leaves containing from 12 to 13 per cent. of moisture, whilst the commercial tobaccos mentioned above contained from 13 to 15 per cent. It will thus be seen that the percentage of saccharine matter varied very largely in these specimens, and from considerations which it would lead me too far to detail here, I am inclined to believe that even in the same plant the percentage will vary in accordance with the development, with the activity of growth, and also with the conditions of climate.

Although these experiments with fresh leaves are of some value in according additional proof that saccharine matter is a never-failing constituent of the tobacco plant, they are in no way conclusive as to the quantity which may under more favourable circumstances be produced by this plant. It is more than probable that the varieties which, even when grown in this country, produced as much as 9 per cent., may, when cultivated in Virginia, yield a very much larger quantity, and even so large an amount as the 15 per cent. found in "Bright Virginia" seems now no longer surprising.

I am informed that it is only of late years that tobaccos with a notable percentage of saccharine matter have made their appearance in commerce, when, in consequence of the fashion of cigarette smoking becoming more general, the great demand for the yellow sun-dried tobaccos induced the Virginian growers to produce a tobacco imitating the Turkish type, and should it hereafter be proved that some kinds of yellow tobaccos from certain localities invariably contain considerably more of it than others, we may safely conclude that this development of saccharine matter is a mere accidental effect of the improvement of the cultivation.

From a pamphlet on tobacco published at Richmond, Virginia, by Robert L. Ragland, we learn how much care and attention are required in the cultivation and curing of the yellow tobacco. The author gives full particulars as to the conditions and temperatures under which first the yellowing process and then the fixing of the colour, *i.e.* drying of the leaves, is carried out. Without entering into the technical details of this manufacture, it will be sufficient to state that the conditions observed are precisely those which would preclude as much as practicable every possibility of fermentation or the destruction of saccharine matter contained in the green leaves.

For the present, we are ignorant of the chemical changes involved in the yellowing process, but it seems not unlikely that it resembles the ripening process of fruits, and we may therefore surmise that an additional quantity of saccharine matter is thereby produced. This hypothesis receives some support from the observed fact that the vigorously growing leaves of certain plants will show a little while after being cut off, an increase in the amount of sugar produced by them.

Although I have in the foregoing shown that a very considerable quantity of saccharine matter may be present in certain kinds of tobacco

as a natural constituent, I had no means of proving that so large an amount as 15 per cent. (the quantity I found in the best bright Virginia leaf) was produced by the plant itself. I may, however, mention some facts which I think very clearly show that it is by no means an easy matter to effect an addition of sugar to tobacco without its presence being betrayed.

According to direct experiments made with some of the yellow tobaccos under examination and with one of the specimens of leaves from Kew, it seems that the amount of matter they contain which is soluble in cold water, varies only within a few per cents.

Bright Virginia	{ 56·1 soluble in water.
	{ 43·6 insoluble in water.
Virginia leaf	{ 57·7 soluble in water.
	{ 42·0 insoluble in water.
<i>Nicotiana Tabacum</i> , var.	{ 58·0 soluble in water.
<i>attenuata</i> , from Kew.	{ 42·5 insoluble in water.

It will be readily seen from this that the addition of even a few per cents. of sugar to tobaccos of this class would upset the average proportion of soluble and insoluble matter, unless a proportionate amount of soluble matter had been previously removed.

I made also an experiment to introduce sugar into one of the inferior kinds of Virginia leaf by means of steeping the leaves into a sugar solution of moderate strength, and drying them carefully afterwards. I found that by this process not only was the colour very considerably deteriorated, but the sugar seemed to have penetrated but little, for its presence on the surface was readily perceptible by the stickiness and sweet taste.

Having now given my answer to the first question, by having shown that saccharine matter forms a natural constituent of the tobacco plant, and that there is every reason to believe that the saccharine matter found in the particular kinds of commercial tobaccos under consideration is also natural and not added, I will now enter upon the discussion of the second question, as to whether such natural sugar can be distinguished with sufficient certainty for revenue purposes from that which may be added.

The many substances which are comprised in the general term "saccharine matter" or sugar, are characterised by certain chemical and physical properties which they have in common, and by which as a class they can be recognised. We are also acquainted with certain specific reactions by which the principal members of this class of bodies, viz., cane sugar (saccharose), fruit sugar (invert sugar), and starch sugar (glucose or dextrose) can be detected when mixed with other soluble substances, without actually separating or isolating them. In conjunction with these chemical reactions, it is the optical test, *i.e.* the specific action of the different sugars on polarised light, which affords the means we depend on when we search for them or wish to determine their quantity.

It is thus that the well-known "Fehling's copper test" and the "fermentation test" have both revealed the presence of a substance or substances contained in certain tobaccos, which must be considered to belong to this class of chemical substances. On the other hand, however, the polariscope failed to indicate the presence of saccharine matter. Only a very faint left-handed rotation could be noticed which was out of all proportion to the amount of saccharine matter indicated by the two chemical tests.



I noticed this inactivity on the polarized light, not only when testing the commercial tobaccos, but also in a few cases when the material from fresh leaves was sufficient for the experiment.

This want of optical activity is very remarkable, and as the saccharine matter of tobacco differs in this respect from the ordinary sugars we must conclude that we have to do here with a new kind of sugar peculiar to tobacco. However, before this could be accepted as a fact, we had to dispose of the possibility that this inactivity might be caused by the interference of the large amount of other matter with which it is associated.

Besides this, it was just possible that this saccharine matter was in reality fruit sugar, or invert-sugar, in which the two compounds, the left-handed rotating *lævulose*, and the right-hand rotating *glucose*, are present in such a proportion that the rotation is compensated and becomes nil. For the present purpose, it was of special importance that this uncertainty should be removed, the more so as I have it on good authority that inactive invert-sugar has every now and then been noticed in commerce, and, therefore, the polariscope might not under all circumstances prove to be so reliable a means for detecting in manufactured tobacco any surreptitious addition of sugar.

Conclusive evidence could only be obtained by a chemical study of the tobacco sugar in its pure state, and for this purpose I have prepared, with the expenditure of much time and labour, a sufficient quantity of this substance in as pure a condition as the known methods for isolating these kinds of bodies will admit.

The saccharine matter thus extracted from Bright Virginia leaf forms an amorphous gum-like pale yellow substance, readily soluble in the strongest alcohol, and also in water, with which it forms a thick treacle, possessing but a very faint sweet taste, which is another marked difference from the ordinary sugars.

On submitting now this substance to a further treatment which, under the supposition that it was composed of *lævulose* and *glucose*, would have effected their separation, I obtained a small quantity of a body which, like *lævulose*, formed with caustic lime a solid compound, but turned the ray of polarized light to the right, whilst the larger bulk formed a liquid compound with lime, and exhibited a very small rotation to the left.

These results lead me to the conclusion that neither *lævulose* nor *glucose* was present, and that the saccharine matter of tobacco is composed of at least three different sugar-like substances which, so far as my present knowledge goes, I must consider as new to chemistry.

As the practical result of this investigation, I must, therefore, express it as my opinion that the presence of natural sugar in tobacco does not preclude the possibility of detecting by ready means any ordinary sugar which might be added to manufactured tobacco.

December 17th, 1883.

## DVI.—MISCELLANEOUS NOTES.

Botanical Magazine for January.—All the subjects figured are from drawings prepared from plants grown at Kew. *Talauma Hedysoni*, long known from the fine representation of it in Hooker's *Illustrations of Himalayan Plants*, flowered in the Temperate House, after being

20 years in the establishment. Unfortunately the gorgeous flowers fall almost as soon as they expand. The showy *Acidanthera æquinoctialis* (Iridæ), was raised from corms sent from Sierra Leone, in 1893, by Captain Donovan. *Lonicera Alberti* is one of Dr. Albert Regel's numerous discoveries in Turkestan, and was raised at Kew from a young plant presented by his late father Dr. de Regel, Director of the Imperial Gardens at St. Petersburg. It is one of the prettiest species of the section *Xylosteum*, having lilac-purple flowers; but it appears to require a continental climate to attain full development. *Acacia spadicigera* is one of those species having enormous spine-like, hollow stipules, commonly tenanted by fierce ants, which serve to protect it from a variety of foes in its native country, Mexico and Central America. The Kew plant was obtained from M. Linden of Ghent, in 1882. *Cyrtopodium virescens* is a Brazilian species, imported by Messrs. Sander, from whom the Kew plant was procured in 1893.

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**Hooker's Icones Plantarum.**—The second part of the current volume, plates 2426 to 2450, contains figures of several plants of unusual interest. Foremost among these is the Juan Fernandez sandalwood, *Santalum fernandezianum*, of which some particulars are given in the *Kew Bulletin*, 1894, p. 110. *Woodrowia* and *Halopyrum* are new genera of grasses from India. Several of the novelties discovered by Mr. Lunt (the Kew collector who accompanied Mr. Bent's expedition to Hadramaut), and previously described in the *Bulletin*, are figured, including the new genus *Bentia* (Acanthaceæ), *Blepharispernum hirtum* (Compositæ), the singular *Ipomœa crinigera* and the outlying malpighiaceus *Acridocarpus orientalis*. *Phillipsia fruticulosa* is a new genus of Acanthaceæ from the neighbouring Somaliland. *Cyclocheilon somaliense* (*Kew Bulletin*, 1895, p. 222) is an anomalous genus from the same country referred to the Scrophularineæ, though further investigation leads to the conclusion that it would be better placed in the Acanthaceæ.

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**Hand-list of Orchids.**—This hand-list was issued in January. The following account is given in the Preface of the history and extent of the orchid collections at Kew:—

“The collection of Orchids cultivated at Kew is essentially different from any, at least in this country, in the possession of a private collector, and perhaps its only rival is that of the Royal Botanic Gardens, Glasnevin. Its main object is botanical and to represent the family *Orchidæ* in as comprehensive a way as possible. The scientific interest attaching to orchids is very great. But even as regards form they can only be studied from dried specimens with great difficulty, and as regards their varied and remarkable structural arrangements and the striking mechanical contrivances for cross-fertilisation which they exhibit, they cannot be studied in the dried state at all. While the Kew collection contains representatives of all the most beautiful and popular species, it is more especially rich in others which at first sight are not particularly attractive. Most of these, however, on careful examination will be found to possess no small degree of charm and interest.



"In 1880, Dr. Pfitzer, Professor of Botany in the University of Heidelberg, came to Kew to study in the Jodrell Laboratory the Kew collection of orchids for his well-known researches on their morphology, and he has continued to draw on it since for further aid.

"Dried herbarium specimens of orchids are not easily procurable. Species frequently flower at Kew of which no other material exists available for study. By this means the Herbarium of the Royal Gardens has been continuously enriched. And in this respect it is also under great obligations to Glasnevin, the Right Honourable Joseph Chamberlain, Sir Trevor Lawrence, and others.

"The task of exhibiting a collection of orchids to the public is not an easy one. The dimensions of the houses which are suitable to their cultivation and the conditions which it requires are such as to preclude the admission of visitors. This is, however, of the less consequence, as when out of flower their general aspect for the most part is not, except perhaps to the expert, either instructive or interesting. The two public orchid houses at Kew, Nos. 13 (warm) and 14 (cool), contain for the most part only the plants which happen to be in flower at any particular period. These houses are not suited to the permanent cultivation of the bulk of the collections which at other times is carried on in the orchid pits (No. 15), to which the public is not admitted.

"The cultivation of orchids is one of the most remarkable developments of modern horticulture. Kew has neither the means nor the accommodation to compete with the magnificent displays of certain species to be seen in the gardens of many private growers. The President of the Royal Horticultural Society in 1885 complained, in his opening address to the Orchid Conference held in that year, that 'there is no sufficiently representative collection of orchids there (at Kew) at present.' It is hoped that the present Hand-list, which enumerates 200 genera and 1800 species (including about 50 garden hybrids), will remove that reproach as far, at any rate, as its representative character is concerned. And it is only right to say that in arriving at this result Kew is under great obligations to the liberality of Sir Trevor Lawrence, the Keeper of the Royal Botanic Gardens, Glasnevin, and various private growers and commercial firms, especially amongst the latter Messrs. F. Sander & Co., of St. Albans. The bulk of the collection has, however, been built up by direct importation and purchase.

Orchids have been continuously cultivated at Kew from their earliest introduction into this country. The varied fortunes which have attended the collection practically reflect the history of the progress which has been made in the art of growing orchids under artificial conditions.

The first exotic orchid which was introduced into English gardens was *Bletia verecunda*, which was obtained from Providence Island, Bahamas, by Peter Collinson, in 1731, and flowered in the following year in the garden of Mr. Wager. About the year 1778 *Phaius grandifolius* was imported from China by Dr. Fothergill, and a full-sized coloured figure of it is given in the first edition of the *Hortus Kewensis* under the name of *Limodorum Tankervilleæ*. A peculiar interest attaches to this plant because it was in it and at Kew that in 1802 Francis Bauer, who was "resident draughtsman for fifty years to the Royal Botanic Garden," discovered and figured the "nucleus of the cell," an all-important body, the first description of which was published by Robert Brown in 1833.

In the first edition of Aiton's *Hortus Kewensis* 15 non-British species are enumerated as cultivated at Kew. Sir J. E. Smith wrote: "We

have scarcely seen any one species of this genus [*Epidendrum*], except in a dry state, before the year 1787, when *E. cochleatum* flowered at Kew, nor was it till October 1782 that *E. fragrans*, of Swartz, exhibited its rich and elegant bloom in the same rich collection. At present several species are to be seen flowering in the spring and autumn."

In the second edition of the *Hortus Kewensis* (1813) 115 species are enumerated, of which 84 are exotics belonging to 39 genera, "the greater number," John Smith states, in his *Records of Kew* (p. 228), "being epiphytal and natives of the West Indies, a few of the East Indies, Cape of Good Hope, and New South Wales."

According to the same writer Dr. Roxburgh sent a number of species from India in the early part of the present century. These, writes John Smith, "I found growing in 1822, on a shelf above a flue against the back wall in what was then called the propagation house; the *Aerides* growing and flowering freely, its roots clinging to the back wall, as also *Saccolabium guttatum*. There were also plants of *Dendrobium Picardi* and *D. cucullatum* flowering freely, which had recently been brought home from Calcutta by Mr. Pierard." But it was to Roxburgh that English gardens owed, besides the first *Aerides*, the first *Dendrobium*, and the first *Vanda*.

These "back walls" are only seldom found in modern horticultural structures; but they were not without their merits.

At this period, with the exceptions above mentioned, the orchids at Kew "were potted in common soil, and the pots plunged to the rim in a tan bed." It is not surprising that their cultivation was attended with little success.

A little earlier than this the first step was taken in the direction of modern treatment. Sir Joseph Banks devised and carried out at Isleworth a method which was "one of the most successful modes of treating epiphytal orchids then known." Mr. H. J. Veitch, F.L.S., in his excellent historical account of "Orchid Culture, past and present" (*Journ. R. Hort. Soc.*, 1889, xi., pp. 115-126), remarks:—"This was the first rude forerunner of our modern orchid basket, and the first instance I find recorded of moss being used for surfacing" (p. 118).

According to John Smith (*Records*, pp. 229, 230):—"Between the years 1823 and 1825 a considerable number of species were received from Trinidad, forwarded by Mr. David Lockhart, the superintendent of the garden, amongst which were the first plants of *Stanhopea insignis*, *Oncidium Papilio*, *Lockhartia elegans*, *Catasetum tridentatum*, *Ionopsis pallidiflora*, and others, all of which were epiphytal, and many of them being sent growing on portions of branches as cut from the trees, which being accompanied by instructions from Mr. Lockhart as to how they should be treated, led to the successful cultivation of epiphytal orchids."

A whole generation was, however, to pass away before the culture of orchids was placed on an intelligent footing. Dr. Lindley during the middle part of the present century dominated the horticultural world. In 1830 he read a paper before the Royal Horticultural Society, in which, generalising from insufficient data, he concluded "that high temperature, deep shade, and excessive humidity are the conditions essential to the well-being of the plants" (Veitch, *l. c.*, p. 119). Thirteen years later he was substantially followed by Mr. Bateman: "except the important direction to give the plants a season of rest" (*l. c.*, p. 120).

The cultural treatment approved by Lindley "became, as it were, the only orthodox one, and was generally persisted in, in all its essential points, for upwards of thirty years."



Two men, however, broke away from the current tradition and with conspicuous success. "One of the first of these was Joseph Cooper, gardener to Earl Fitzwilliam, at Wentworth" (1835). "A still bolder innovation was adopted shortly afterwards by Paxton, at Chatsworth." In both cases the essential innovations were lower temperature and increased ventilation. The old tradition still, however, held its ground:—"plants perished under the barbarous treatment they received in the hot-houses of this country almost as fast as they were imported. To such an extent were the losses felt, that Lindley, in a remarkable article published in the *Gardeners' Chronicle* towards the end of 1859, pronounced their treatment 'a deplorable failure,' and which Mr. Bateman also some years later characterised as 'incredible folly'" (Veitch, *l. c.*, p. 123).

The first great step in the improvement of orchid culture was "the heating of glass-houses by means of hot-water pipes, which were first used for this purpose on a small scale by Mr. Anthony Bacon, at Aberaman, in Glamorganshire, and afterwards by the same gentleman at Elcot, near Newbury. The inventor of the process is said to have been a Mr. Atkinson" (Veitch, *l. c.*, pp. 122, 123).

The same writer sums up in the following words the chief features of modern practice:—"Larger and more airy structures, with separate compartments for different climates (for large collections even separate houses); a lower average temperature, the admission of more light and air, and a better system of heating, shading, and ventilation" (*l. c.*, p. 124).

It must, however, be admitted that a considerable number of species still refuse to submit to horticultural conditions. *Cattleya citrina*, many species of *Oncidium*, and the beautiful Cingalese *Dendrobium MacCarthiae* are examples familiar to every orchid grower.

One species, however, that is usually found to be intractable, *Diacrium bicornutum*, has always been grown at Kew with little difficulty. On the other hand it seems impossible to grow *Disa grandiflora* there with the success that attends its cultivation at Edinburgh and Chatsworth. Perhaps the most baffling genus of all is *Anactochilus*, the species of which, under apparently identical conditions, will sometimes flourish with facility, while at other times, for no discoverable reason, they refuse to grow at all.

In 1845 the span-roofed house, which now forms the east wing of the Tropical Fern House (No. II.) was erected on the site of an old stove (No. 3 of Dr. Lindley's Report). Sir William Hooker described it (in 1846) as "occupied with a rich and inestimable collection of orchideous plants (of which a great proportion was presented by Her Most Gracious Majesty)." This gift was recorded by him in 1844 as "the entire and valuable collection of orchideous plants formed at Woburn Abbey, which on being offered to Her by the present Duke of Bedford, Her Majesty was graciously pleased to accept and to send to the Royal Gardens at Kew." Continuing Sir William Hooker's account of the house:—"the centre is filled with a handsome slate staging, so large as to admit of a raised walk through the centre, thus enabling the visitor to look down upon each side of the house, while, over his head, and from the rafters on either hand, are suspended wire baskets filled with beautiful tropical epiphytes . . . . As the house in question opens on to another and cooler stove (No. 2, now the west wing of No. II.), we are enabled to remove the splendid epiphytes, when in blossom, to a less heated atmosphere, and thus preserve them in beauty for a much longer

time. The orchideous house is assuredly one of the most interesting among the novel features of the establishment."

In 1847 Sir William Hooker further recorded:—"The orchideous house . . . has proved admirable for its structure, mode of heating, and the general arrangement; the plants, which have been increased [1846] by the noble bequest of the Rev. J. Clowes, of Broughton Hall, near Manchester, who willed his splendid collection of *Orchideae* to the Royal Botanic Garden." It is somewhat remarkable that this is the only bequest which the orchid collection at Kew has ever received.

Many of the orchids, however, did not thrive in the house provided for them, which proved too large for the smaller species. These were therefore removed to the present orchid pits (now No. XVI.) about 1851. From about 1855-1862 part of the collection was maintained in some old fruit-houses in the present herbaceous ground, which had been remodelled and heated by hot water. In 1863 the whole of the orchids had been removed to these houses and they remained in them till the erection, in 1869, of those in which they are now exhibited to the public. The old houses were pulled down.

The orchid pits (XVI a & b) are amongst the oldest structures in the establishment. They are the "double propagating pits" of Dr. Lindley's Report (1840). The north end is formed by the only remaining portion of the wall of Methold's garden (it having originally belonged to Methold House, the Director's present official residence), which was added to the Botanic Garden in 1846. These pits were heated with hot water in 1842 and rebuilt on more modern principles in 1884. The small *Masdevallia* house (XVI c) to the north was reconstructed in 1893.

According to John Smith (*Records*, p. 235), "in 1848 the number of species cultivated at Kew amounted to 755 and in 1850 to 830." By the same authority it is stated in 1864 to have been 638. In 1868, according to the *Botanical Magazine* (t. 5692), "Kew only possessed about four hundred epiphytic orchids"; in this enumeration there is probably some error, as in 1872 the number of species and varieties in cultivation was 851 belonging to 138 genera. Since that time the collection has steadily increased.

The *Kew Bulletin* for 1891 (pp. 52-75) contains a list of the orchids, 766 in number, which flowered in 1890.

One striking evidence of the mastery which horticulture has gradually acquired over this difficult branch of cultivation is the successful production and rearing from seeds of hybrids.

This commenced with the work of Dominy in the nurseries of Messrs. J. Veitch and Sons at Exeter in 1853, and it has been continued ever since with increasing interest and success. It has not been without its scientific value in indicating that many genera, reputed to be distinct, are more closely related than had been supposed. The great range of species which Kew has at its command suggests attempts of this kind. And in the genus *Disa* it has produced crosses which are easy of cultivation and will probably become popular as ornamental plants.

For the convenience of cultivators a reference has been given, as far as possible, to a published figure under each species. Where available, those in the *Botanical Magazine* have been cited. In other cases preference has been given to the most easily accessible figure. It must, however, be noted that a species is, in many cases, figured under a different name (synonym) to that cited in the Hand-list.



A few names current in gardens have been included which have not as yet received a final botanical revision; these are indicated by the abbreviation "*Hort.*" appended to them.

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**Water Supply.**—During the past year an important addition to the pumping machinery has been made by the erection of a triple expansion high duty engine as an auxiliary to the compound beam engine which was supplied by Messrs. James Simpson & Co. in the year 1864. The new engine represents the very latest development of the direct-acting type which has been adopted by the majority of the water companies at home and abroad. It has two high-pressure, two intermediate, and two low-pressure cylinders, arranged in line, and driving the pumps direct by prolongations of the piston rods, the dimensions of the cylinders being 8 ins., 11 ins., and 19 ins. respectively. All cylinders are steam jacketed.

The special features of this class of engine are the very small amount of fuel expended per indicated horse-power, and the smoothness and efficiency in working. The discharge from the pumps being practically continuous there are no shocks upon the mains and they are consequently free from the fluctuations of pressure which attend the working of engines of the old type. The new engine has been designed and manufactured by Messrs. James Simpson & Co., of Grosvenor Road, Pimlico, and the general finish of the work is of the highest class.

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**The British Honduras Pine.**—There has long been an impression in the colony of British Honduras that there are two species of pine on the "Pine Ridges," distinguished, as Dr. D. Morris, the Assistant Director, states (*The Colony of British Honduras*, p. 57) as white and yellow pine, "and supposed to be characterised in the one case by rather smooth and compact bark, and in the other by rather thick, spongy, and rough bark." He, however, was unable on the spot to find any botanical characters to separate what were pointed out to him as the yellow and white kinds; and the specimens sent by him to Kew were identified as *Pinus cubensis*, Griseb. The present Governor, Sir Alfred Moloney, has sent further material which confirms the original identification. Grisebach (*Catalogus Plantarum Cubensium*, p. 217) distinguishes two varieties, which may prove specifically distinct as Wright, the collector, seems to have thought. The one has *foliis ternis, raro geminis*; the other *foliis geminis, raro ternis*, associated with differences in the cones. The latter is named var. ? *terthrocarpa*, Wright. The Honduras Pine is the same as the former, and therefore the original *P. cubensis*, Griseb. It is true that the leaves sometimes vary in number, as indicated above, in both varieties, and on the same branch; but there is not sufficient material at Kew to settle the question and define the species. The two other known West Indian species, *P. occidentalis* and *P. bahamensis* are easily distinguished; the former having the leaves in fives, and the latter very long leaves; but the



numerous Mexican and Central American forms require critical revision before the limits of the species can be defined. There is one point in connexion with the shape of the leaves in cross section which does not appear to be very generally known. It is this: when there are two in a sheath they are concavo-convex; when there are three in a sheath they are biconcavo-convex, the inner face being concave or biconcave. So far as the Kew material goes, all the leaves of the Honduras specimens appear to be in threes.

Sir Alfred Moloney also sent specimens of the Honduras oak (*Quercus virens*) which, like the pine, descends to the sea coast, and is associated with palms and other trees of tropical types.

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**Beetle larvæ attacking Orchids.**—Sir Trevor Lawrence, the President of the Royal Horticultural Society, submitted to Kew pseudobulbs of *Dendrobium Imperatrix* attacked by larvæ. Mr. W. F. H. Blandford, Lecturer on Entomology at the Forestry branch of the Indian Civil Engineering College, has kindly furnished the following report upon them:—

These are beetle larvæ, and pretty certainly those of a Longicorn-beetle. They show, however, some slight divergences from the ordinary type of Longicorn-larva, correlated, I believe, with their habitat, in a soft stem instead of hard woody tissues.

It is quite impossible to identify such larvæ except when their mode of life is such as to exclude any doubts. But it happens that the larvæ of the only two known species of the genus *Diaxenes*, Waterh., live in orchids.

The first species, *Diaxenes Taylora*, Waterh. (*Ann. & Mag. Nat. Hist.*, ser. 3, vol. xiii., p. 128) was described from an example found in the Royal Nursery, Chelsea, where it was gnawing the stem of a *Phalaenopsis* from Manila. Three examples in the British Museum are ticketed "Moulmein."

The second species, *Diaxenes dendrobii*, Gahan (*Ann. & Mag. Nat. Hist.*, ser. 6, vol. xiii., p. 520) is known by four specimens taken alive on imported orchids. The species of orchid were *Dendrobium atropurpureum* and *D. nobile*, the last imported from Moulmein.

Whether the larvæ before me belong to either species of *Diaxenes*, or even to the genus must necessarily remain unknown, unless the beetle be bred from them. But I should conjecture that, from the habitat of the host-plants, it will prove to be distinct.

Should Sir Trevor Lawrence be so unlucky as to breed out the beetles in his conservatory, I should be glad to see them and examine them. But for the sake of the orchids, I would recommend that they be carefully looked over and the affected stems destroyed. If any plants are so attacked as to be not worth saving they might be removed to a house which contains no other orchids, and covered with gauze netting so as to detain any beetles which may breed out, if it is desired to rear them for examination.

But it is most important that by careful supervision no affected stems shall be left which will distribute the insect at large in the orchid-house when they have reached the winged stage. It might be possible to save pseudobulbs not as yet badly injured by destroying the enclosed



larva with a wire or needle, but whether this means is practicable or not must be left to the consideration of those who have care of the plants.

WALTER F. H. BLANDFORD.

I may add that I have described a small boring-beetle (*Xyleborus morigerus*) which has been very injurious in some conservatories to *Dendrobia* from New Guinea, having probably been sent out extensively with the orchids by a firm of nurserymen. It is, however, not present in the portions sent.

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**Solanum torvum in Assam.**—The following note is extracted from a *Report on a Botanical tour in the Lakhimpur district of Assam*, by G. A. Gammie, Assistant, Government Cinchona Plantations, Mungpoo (*Records of the Botanical Survey of India*, i. pp. 70–71):—

“The military outpost of Sadiya, situated close to the right bank of the river, is surrounded by far reaching stretches of grass savannahs interspersed by coppices of small trees. A large annual bazaar was formerly held here to the mutual advantage of traders from the wild tribes in the mountains and merchants from the low countries, but I believe they were discontinued a year or two ago on account of the virulent epidemics which broke out among these large gatherings of people.

In favourable situations in Sadiya the trees are of noble growth compared with those that form the copses.

In addition to the grass lands at this isolated settlement a remarkable feature is the sterile aspect of some very large tracts covered by a close scrub composed of *Solanum torvum* and *Flemingia congesta*, but principally the former.

Regarding this plant Captain W. H. Lowther sounded a note of alarm in the *Journal of the Agri-Horticultural Society of India*, Volume xi. (1861), page 290. The article is entitled “On the mischievous increase of a gigantic species of *Solanum* on the North-East Frontier of Bengal, more especially in the Tea Districts of Assam.”

He states that the plant was identified as *Solanum torvum*, Swartz, and that it promised to be one of the most stubborn and formidable antagonists with which Indian agriculture would ever have to contend.

So far as he could ascertain the plant only forced itself on notice some ten or twelve years before in Upper Assam where its rapid growth and productiveness had earned for it an evil repute. The fruits are too nauseous to be palatable to human beings, but they are devoured by many animals and birds and the seeds always pass undigested.

The military outpost at Saikwa on the Brahmaputra was deserted chiefly because it was overwhelmed by this plant, which no outlay could diminish or keep in check, and now, at Sadiya, on the opposite bank, the same state of affairs seemed imminent. The heaviest growth is observed on recently deserted fields.

Fortunately we can say, after the lapse of 33 years, that the writer's fears have not been realised and, although *Solanum torvum* is still a pest in the deserted homesteads of Upper Assam, it readily succumbs to the influence of careful and continuous cultivation. Where it flourishes (and that is never in the forests), it stands bearing eloquent

testimony to the pernicious results caused by "joom" cultivation, a custom still followed by the mountain and sub-mountain tribes, but this system is now greatly checked and will soon be traditional in the settled districts. Many areas of valuable land abandoned by indolent cultivators are overrun by this *Solanum*, with other equally harmful shrubs and by many species of strong coarse grasses, long before a more valuable type of vegetation is strong enough to compete with them on equal terms."